Plugging the Brain Drain:

Cultivating the Next Generation of Environmentalists

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Looking Into The Future

- Many Environmental Professionals will be retiring soon; are their replacements ready?
- The median age of the workforce:
  - 1960 30 years 2006 40.6 years
- Number of Workers per Retiree
  - 1950 16 workers/retiree
  - 2010 3.3 workers/retiree
  - 2025 *projected* 2 workers/retiree

In general, the number of Baby Boomers (76 million Americans born 1946 – 1964) entering their retirement years is growing.

Careers for New College Grads

MEDICAL

Someone has to take care of all the aging baby boomers. A significant draw for those entering college will be into the medical profession

- Doctors/Surgeons
- Skilled Nursing Care – hospital/nursing home
- Home Health Care – respiratory/ physical/ occupational therapies

Other Career Choices in Growth Industries

- Tech
  - Satellite/Cellular Communications
    - Internet based services
      - Web design
      - Education
      - Retail sales
  - Computer software/hardware engineering
  - R & D for Green Technology
- Service Industries
  - Direct services
  - Delivery

Cultivating Stakeholders in Clean Water

- The wastewater industry as a whole needs to market itself as an important career option for the next generation
- The number of workers (overall) is shrinking over the next twenty years
- The wastewater industry needs to compete with other industries to capture and retain these future workers
- Creating a sense of environmental responsibility among school-aged children helps to market our industry as a career choice
- Informing school-aged children about the status of their environment is necessary to help them understand that everyone is responsible for the health of the planet

Wastewater? What's that?

- The general public doesn't know the wastewater plant exists, so they do not think of it as a career option
- The general public thinks that most of the water pollution of the 1970's has been "cleaned up", they do not see it as an ongoing process that requires vigilance and oversight by local environmental workers.
- The public understands EPA polices the environment, but doesn't know EPA uses local representatives to manage the day to day work of oversight within the municipality.

Common Misconceptions: Different Water

- ***Many people think their drinking water is some how segregated from surface water***
  - What do you mean my drinking water has been in contact with wastewater from a factory???!!!
  - And Biosolids (aka Poop) ?? Not possible!!!
  - I get my water from an aquifer; that water is uncontaminated by definition. It has been sealed in an underground vault since the dinosaurs roamed the earth, so there is NO WAY any chemicals have gotten into it!

Can't You Clean It All Up?

More misconceptions about water :

- If water is "treated", then it free all of pollutants
- All pollutants are exotic chemical compounds, not everyday things like phosphorus and nitrogen that will always occur naturally
- Whatever I put down the sewer drain can be "taken care of" because it goes to the WWTP
- "Something" happens at the wastewater treatment plant, but most people do not realize it is biological treatment that can be poisoned

Didn't We Get That Done Years Ago?

- Huge environmental disasters stay at the forefront of the public's consciousness as isolated events

  BP Gulf Spill

  Exxon Valdez

  Three-Mile Island

- The garden variety contamination is "old news", so people don't think about the fact that a clean up can take 20 years or more to complete
- Most people don't think of environmental clean-up as an on-going process that requires knowledgeable personnel

The Environmental "Momentum"of the 1970s

- Clean Water Act (regulation of industrial discharge/NPDES permitting)
- Clean Air Act(smog, open trash burning)
- Removal of CFCs from consumer products (hairspray, spray paint, etc.)
- Removal of phosphates from soaps
- Litter Prevention
- Removal of DDT, DDE from pesticides

Economic Incentives Drive Environmental Change

Beginning of OPEC; higher prices for foreign oil resulted in environmental benefits

- Introduction of Daylight Savings Time
  - Lowered electricity consumption by taking advantage of longer daylight hours during warmer months
- Build it Better
  - Fiberglas insulation in new housing construction
  - Insulated windows
- Death of the Land Yacht
  - Smaller cars, better gas mileage, less dependence on foreign oil

How Our Culture Was Changed

- Save money through recycling

  "Reduce, Re-use, Recycle"

- Remove lead from gasoline formulation

- Beginning of Organic Foods
  - Eliminate pesticides from the diet

- Have a Party

  Earth Day made it onto the calendar of our social awareness

How Our Culture Was Changed

- Make it cool to care
  - Life is Fragile, Handle With Care stickers promoting environmental awareness were the coolest thing to have when I was in elementary school
- Advertise in all the right places
  - Public service announcements on TV
- Get the kids on your side
  - The message of turning off lights, turning down the thermostat, and not littering was part of the classroom curriculum

PSAs: A Blast From the Past

Messages received when you are a kid will stay with you for the rest of your life, and be passed on to your children if you thought they were valuable

Examples that have worked: circa 1970-1980s

Litter Prevention Campaign (Keep America Beautiful)

Crying Indian

Fire Prevention Campaign (US Forest Service)

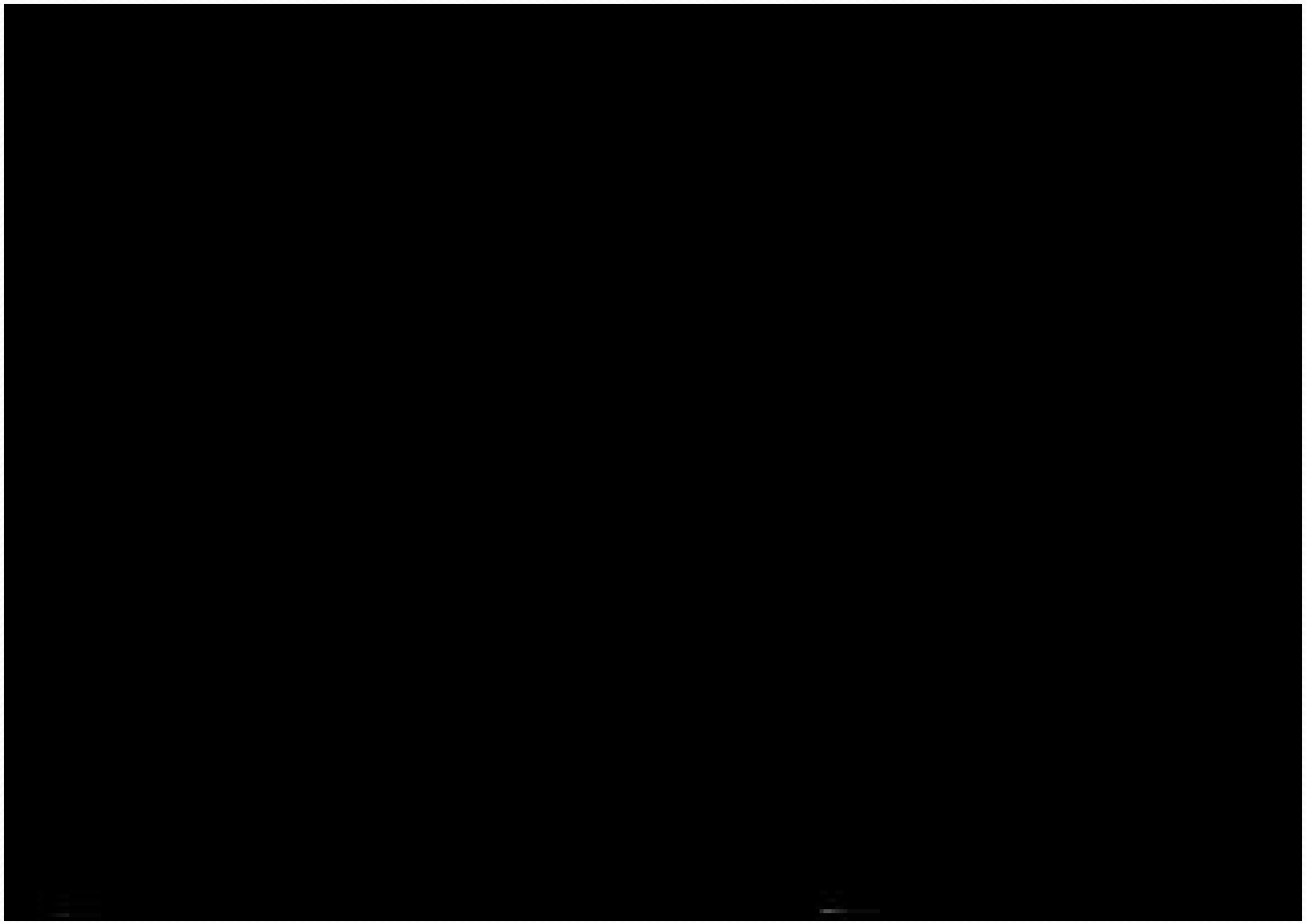
Smokey Bear

Pollution Prevention Campaign (US Forest Service)

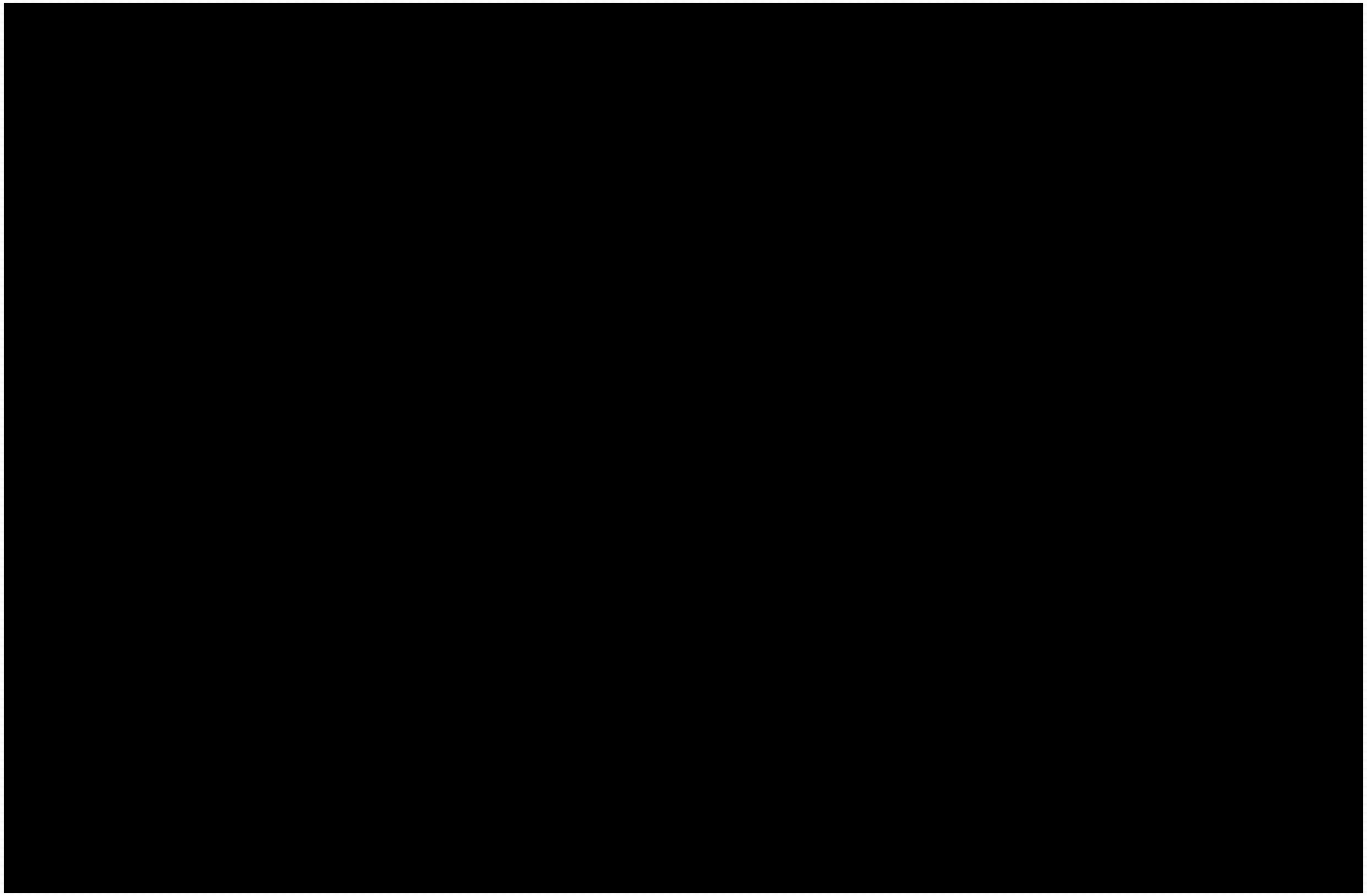
Woodsy Owl

Litter Prevention: The Crying Indian

Fire Prevention: Smokey Bear



Fire Prevention: Careless Bears



Litter Prevention: Woodsy Owl

Re-education on a budget

You may not have the budget for a TV ad, but you can still advertise the Wastewater Industry

- Market your plant with an open house to the public
- Offer tours of your facility to church groups, school groups, Rotary Clubs, etc.
- Market yourself as an Environmental Professional at local events
- Offer training for area teachers through a tour and brief overview of the Treatment Process
- Offer yourself as a guest speaker and do a classroom visit

Incentive to Market Your Clean Water Efforts

Your OEPA Municipal Separate Storm Sewer System (MS_4) permit lists public education as <u>two</u> of the six minimum control measures

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

EPA recognizes the public must be <u>educated</u> and invited to <u>participate</u> for a Pollution Prevention program to be successful

Stuff To Do With School Kids

Here is a short list of the types of presentations you can give in the classroom to help children learn about the importance of wastewater treatment and the social responsibility of a career in clean water:

- Pre-teach what the WWTP does before the class tours your facility (day before, in classroom)
- Do a chemistry hands-on lab with the class
- Check out what lives in your receiving stream with the kids
- Use a visual aid to demonstrate how non-point source pollution can impact surface water
- Build models of an aquifer with the class

Why Teach School Kids

- The State of Ohio 3rd grade science requirement states that the science curriculum must include lessons on the Water Treatment Plant and Wastewater Treatment Plants
- Many children carry with them the misconceptions about water that their parents may have ("…it just disappears when I flush")
- Representing yourself as a working environmental professional introduces them to the idea of Clean Water careers ("I never knew THAT was a job!")

The Municipal Water Cycle

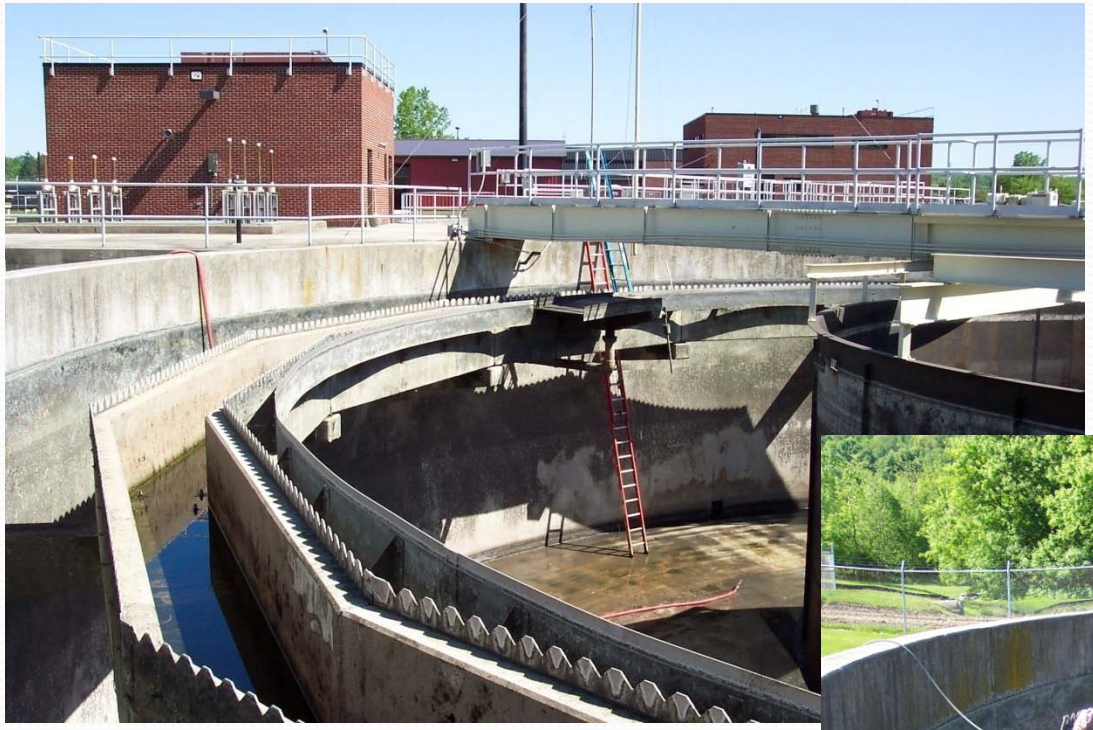
Pre-teach before the class tours the Water and Wastewater Treatment Plants

Show photos of the plant, include photos showing tanks or other structures that have been drained

Explain that the treatment that happens is really all about the bacteria.

Show movies of the protozoa and metazoa that live in your aeration basin. Explain how these are indicators of how healthy your plant is…good bacteria population = good higher life form population

Explain these are what you call “Bugs”; they are not cockroaches or other insects



Show pictures of structures that are normally underwater

These pictures help the audience to understand how diffusers work, and how we can collect the sludge off the bottom of a tank

An Overview Of Your Plant

Legend Elementary Kids on Tour

Both Water Cycles

- The teacher should have covered the Global Water Cycle in class before your visit. This lesson is taught beginning in 2nd grade.

  Ocean + Sun = Evaporation

  Clouds + cooler temperatures in the atmosphere = Condensation

  Lots of humidity in cloud +gravity = Precipitation

- Most teachers don't teach the "Municipal Water Cycle"

river ->WTP -> consumption -> waste ->WWTP -> river

Be Visual- Draw on the Board

Do We Just Remove Solids at the WWTP?

Explain:

There are *insoluble* pollutants that can be settled out at your plant (like the solids)

There are also *water-soluble* pollutants that stay dissolved in the water

Compare this to a salt water solution; you know the ocean tastes salty, but you can't see the salt until all the water evaporates away, leaving the salt behind. The salt *dissolves* into the water = it is a *water-soluble* compound

Describing BOD

Explaining soluble BOD (food) in the water to non-wastewater people is difficult

- Place a hotdog bun and some water into a Ziploc bag
- Explain that the food the bugs eat has the same basic components as the food you eat
- Seal the bag and mash the bun up into the water creating a slurry
- Ask how the audience would get the food out of the water; would a coffee filter get ALL of the little pieces of bun out? Would you have crystal clear water after just filtering it? Would the water still be white?

Why Lower BOD?

Explain that excess food (BOD) in untreated discharge water help to feed algae in the river

Explain why excess nutrients and food cause increased algae growth, and how the algae plants are decomposed (Decomposers use oxygen from the water to live)

Less oxygen in the water means the fish can't breathe, resulting in dead fish (Dead fish get instant sympathy from 3rd grade girls. They don't want to look at them, but they feel sorry for anything that dies)

Bug Movies on You Tube

If you don't have a phase contrast microscope with a camera to make your own movies, you can always download some from You Tube…

Type the name of the organism into the search bar

Tip: Do NOT type in flagella on your work computer!!! Nasty things will be found!

Open Keepvid.com in another internet tab

Find the movie you want on You Tube

Copy the URL address into the Keepvid download bar

Download the movie to your computer

Convert to Windows Media or AVI file using a video converter program. Quick Time won't work in a Power Point show

Vorticella

Aspidisca

Rotifer

Amoeba

Water Bear

Water Chemistry

Kids can do simple color change chemistry testing using a kit manufactured by LaMotte, distributed by WEF for $13

Tests included:

pH	color change	50 tests
DO	color change	50 tests
temperature	LCD thermometer	unlimited
turbidity	Secchi disk	unlimited

Water Chemistry

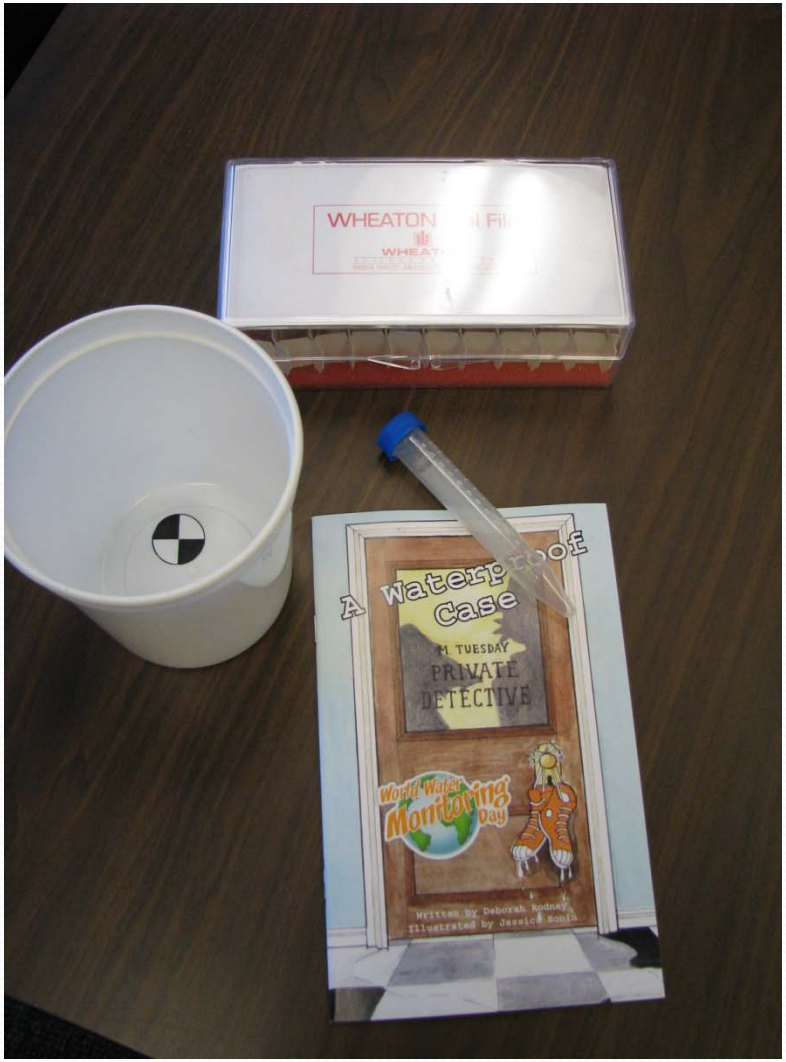
- World Water Monitoring Day
- Sept 16, 2010 official date

- Kits are sent all over the world to allow volunteers of any age to test their local surface water
- Results collected between March 22 and December 31 of each year can be posted to the website. GPS links to the data are used to pinpoint which water bodies are tested

  www.worldwatermonitoringday.org
- 2 fiction books are available featuring a detective trying to solve a water pollution related case

Water Chemistry Kit

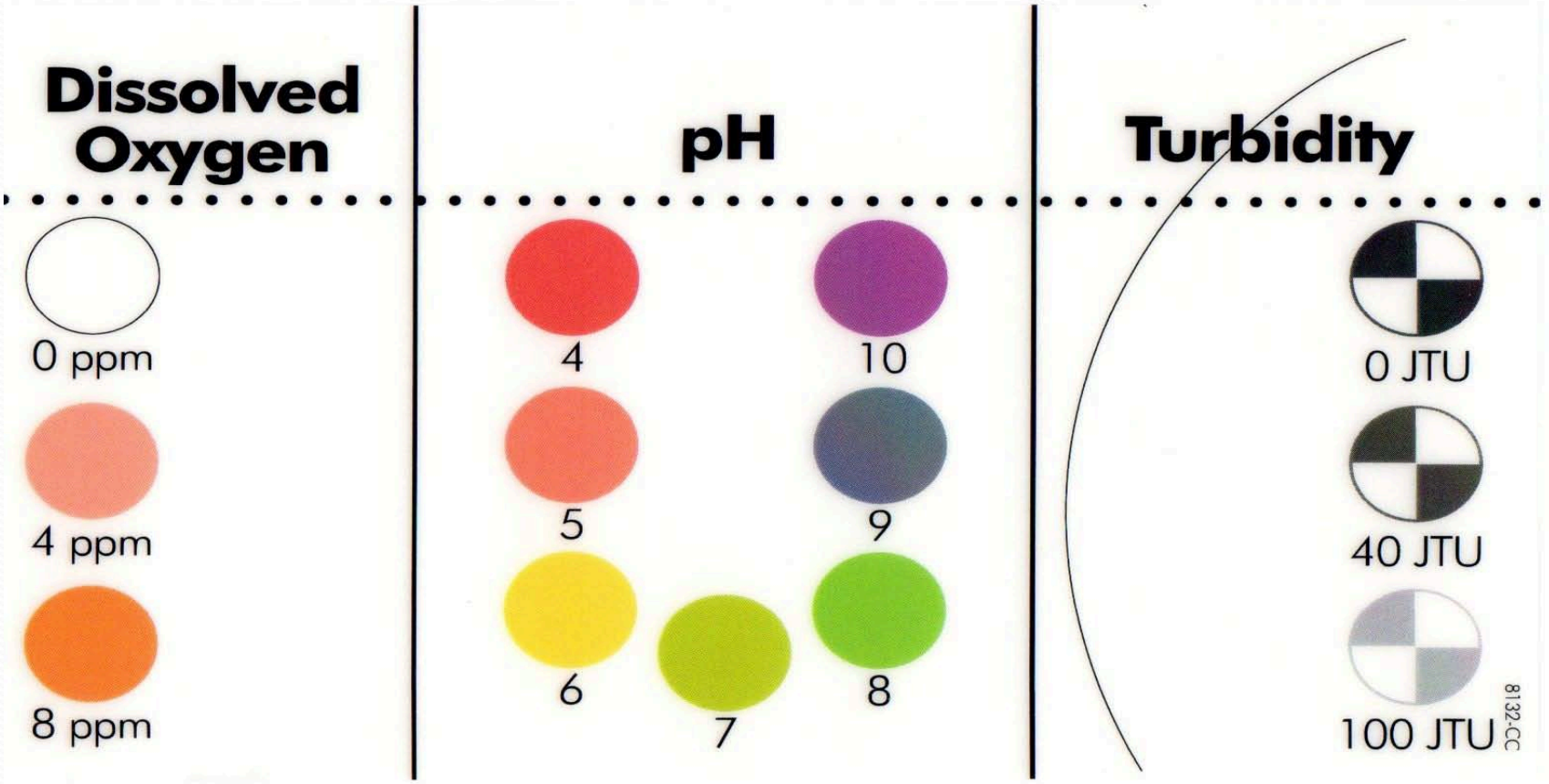
Extras you might want to add



32 ounce white sample containers
More Secchi discs
Draw with Microsoft Paint (already on a Windows PC)
Print with Laser Jet on Weather resistant labels
Wheaton Vial File p/n 228780 DO Test
Centrifuge Tubes pH Test
Silly Bands in Sea Creature Designs
Books to hand out

These books cannot be purchased in bulk, but I usually "donate" kits to cover the prining cost WEF has in the books. I get 100 at a time, and that is usually 5 kits I buy to be donated to other groups

What the Data Will Look Like



Record your findings on a data sheet

Be sure to have discussions with the class about why DO is important

What natural features increase or decrease DO?

What does excess food (BOD) in the stream do to the DO?

Dress The Part

- Wear your lab coat
- Safety glasses
- Gloves

<u>Out fit the kids too</u>

- smaller sized safety glasses *available through Fisher*
- Gloves in cool colors

PTA's may be able to help supply these if you do not have a stormwater budget

Many schools have a photo release policy; check this put before you take pictures to use in a report that might be posted to the Web

Take Kids Creeking

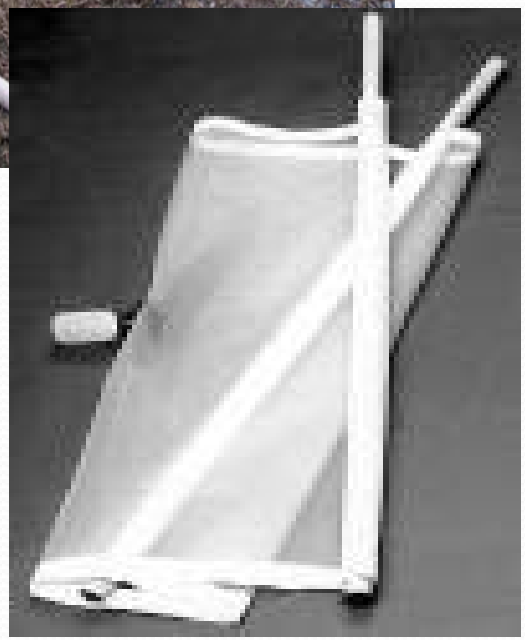
The type and quantity of Macro invertebrates helps to determine how healthy (how polluted) a stream is.

Explain that organism sampling is used by the EPA (along with WET) to decide if a stream needs to be "cleaned up"

Supplies needed:

- A creek
- Aquatic shoes or boots (Rocks are sharp, no bare feet allowed)
- Nets (kick nets, bait well nets)
- Plastic aquarium from the pet store
- Adventurous spirit (especially if it is 50 degrees out!)

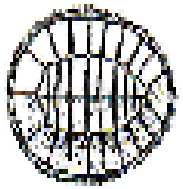
Supplies



Macroinvertebrates Grouped by Level of Pollution Tolerance

(Adapted from EASI and the Senior Environmental Corps, *Volunteer Water Quality Monitoring Field Manual.*
Images from McCafferty, *Aquatic Entomology*, 1981 AND Kellogg, *Monitor's Guide to Aquatic Macroinvertebrates*, 1994.)

Group I: Generally sensitive to pollution. Large numbers of these types of organisms normally indicate GOOD WATER QUALITY.



Water Penny Beetle Larva

Riffle Beetle Adult

Mayfly Nymph

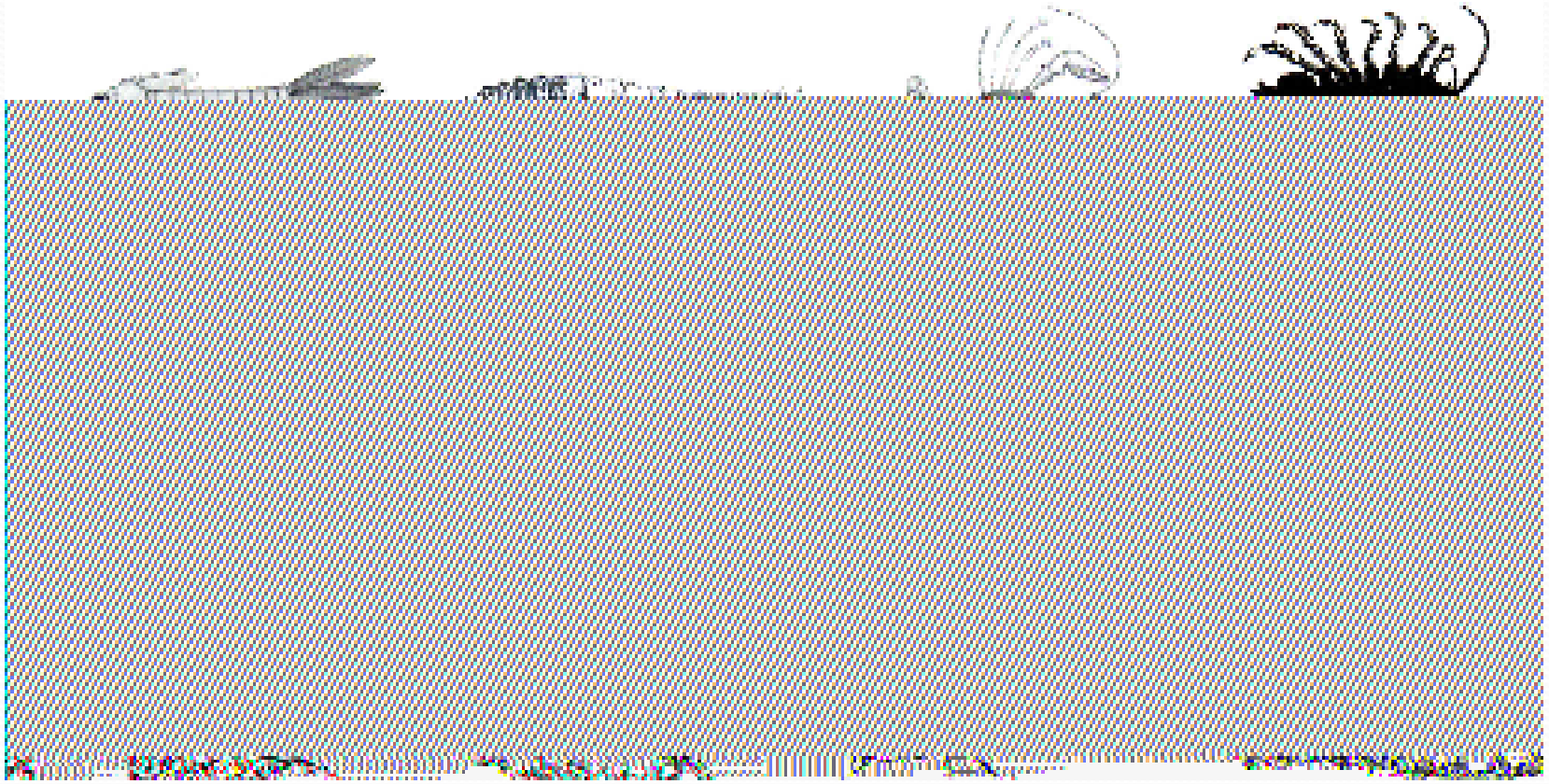
Stonefly Nymph

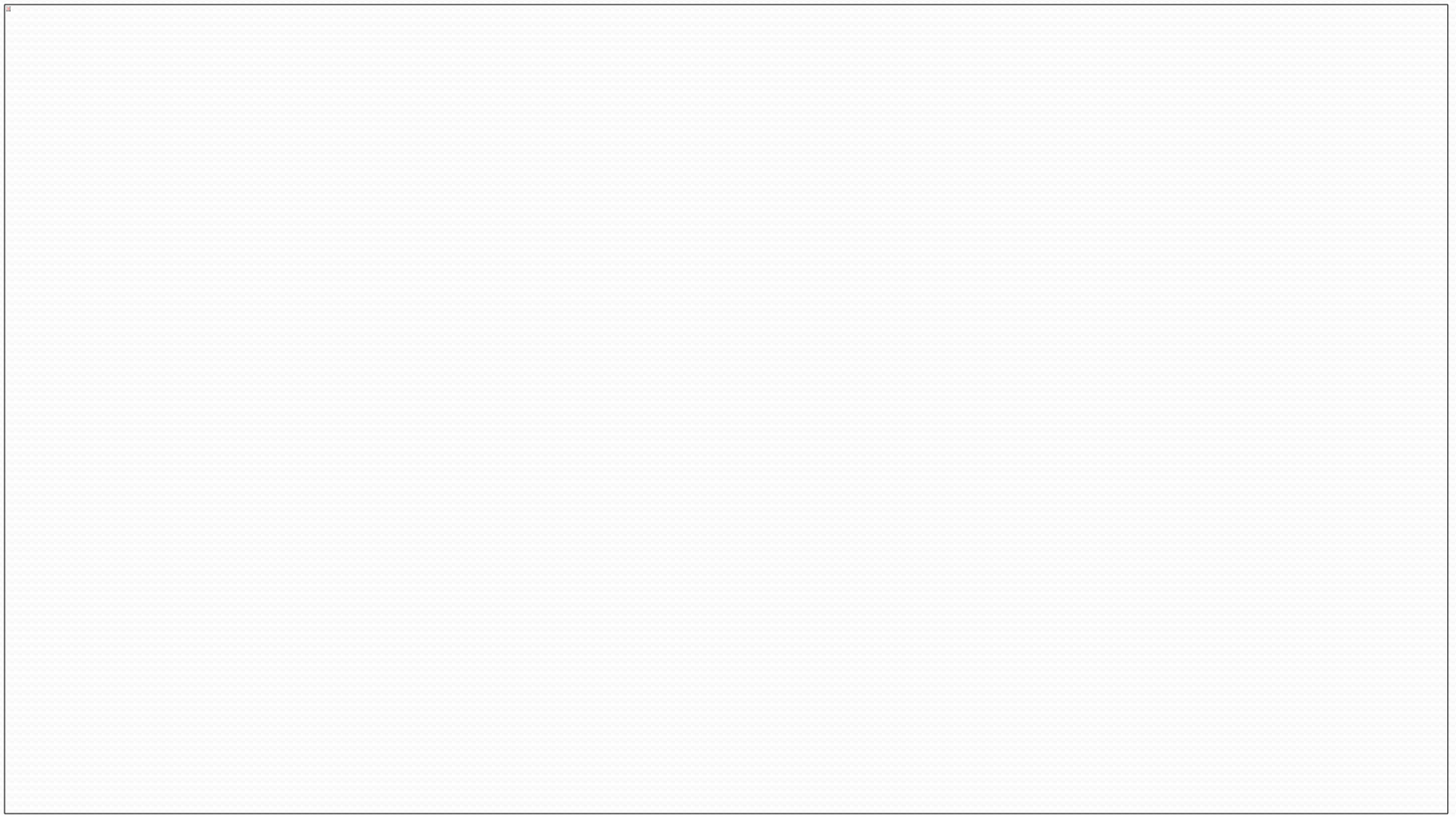
Gilled Snail
(has a thin, horny plate to seal shell opening)

Hellgrammite

Non-Net-Spinning Caddisfly Larva

Group II: Can exist under a wide range of water quality conditions. Large numbers of these organisms, in the absence of Group I organisms, normally indicate MODERATE





Creeking (con't)

- Be aware the organisms you see will change not only with pollution levels, but also with the time of year
- Most larvae live in the rocks at the bottom of the stream.
- Flipping rocks and kicking the stream bed to stir up the organisms will help get them into your net.
- Crayfish move backwards! You need to know this if you are going to catch one…
- DO NOT use your net as a shovel to scoop up the rocks! This may tear the netting
- Kick nets are made of a polypropylene mesh and good ones are $100 or more. Bait well nets work fine for kids; $5 @ Walmart


I AM
THE
LEVY

What Is A Watershed?

The Enviroscape Non-Point Source Model $785

Watershed

Explain that a watershed is the area around a body of water that collects and directs the rain run-off to feed the stream/river/lake/etc.

- The Enviroscape model provides an easy visual demonstration of both point source and non-point source pollution
- Pollution is simulated by sprinkling Kool-aid and coco around on the surface of the model
- “Rain” is simulated with a spray bottle of water
- When the water comes in contact with the powder, the resulting slurry ends up in the lake on the model graphically illustrating runoff contaminating the surface water

Watershed

Modeling Clay and fake vegetation are used to illustrate how Best Management Practices can be used to stem the flow of rainwater into our waterways

The BMPs that are illustrated are:

- Terracing farm fields to help prevent erosion
- Containing cows and their manure
- Prohibiting factory discharge directly into waterways without treatment of their effluents
- Stop clear cutting trees
- Leave buffer zones around waterbodies
- Stormwater collection and treatment

Watershed

- The easiest way to illustrate the BMPs is to put everything in place first
- modeling clay to terrace fields
- cow manure in containment
- cows kept out of the river with a fence
- grass strips around the river and lake
- stormwater drains plugged (no direct discharge of parking lot runoff)
- trees left in forest

Watershed

Sprinkle the "pollution" around on the model:

- Parking lot - oil
- Cow field – manure that is deposited in the field
- Forest – eroded soil
- Golf course and houses – pesticides
- Factory – discharge (you have to sprinkle this on the roof to get it to come out of the effluent pipe)

Make it rain and see if the pollution is prevented for entering the river

Watershed

Now remove your safeguards, re-deposit the “pollution” and make it rain again

More of the colored water will enter the river and lake illustrating the introduction of polluted run-off into our waterways.

If you set the model up with BMPs in place first, you will have an easier time. This way the model can be pre-set before your presentation and you will get the felt strips to adhere better (they won’t stick to wet plastic)

The Farm

Modeling clay strips to represent the terracing

Fence to keep the cows out of the creek keeps the cows from “fertilizing” the creek directly

Stored manure is contained

Factory Discharge

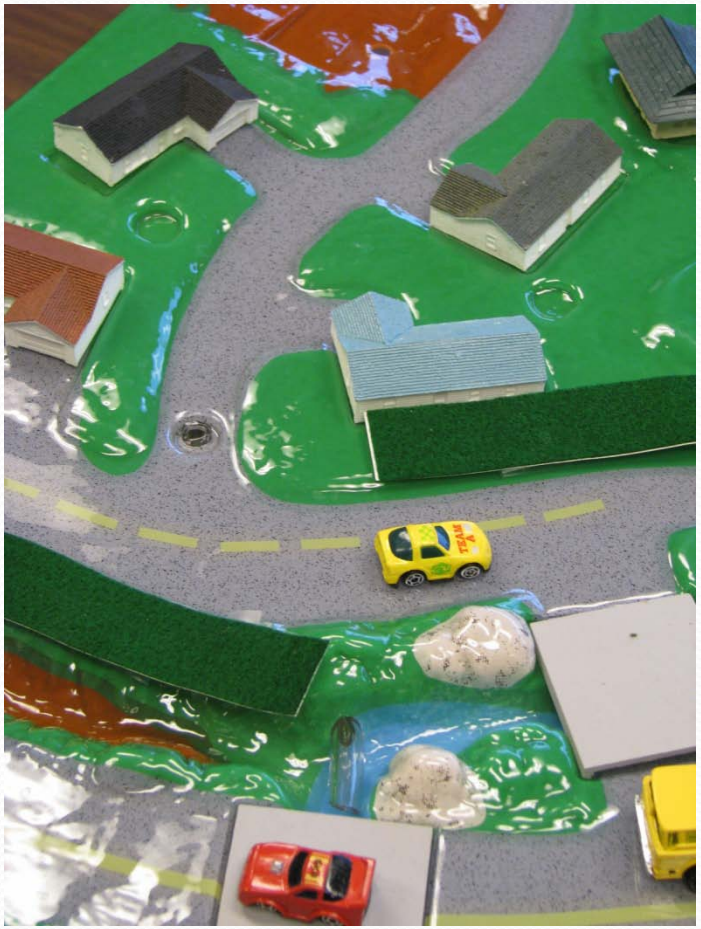
Pollution from the parking lot enters the storm drain (black circle to the left)

Direct discharge is illustrated with the hose directed into a ditch

Clear cutting vs. Selective Cutting

Be sure and put down some “grass” around the trees to simulate the water absorption by the vegetation when demonstrating how selective cutting helps to prevent erosion

Stormwater



Note the storm drain in the middle of the street; it enters the river directly through the plastic tube (above the red car)

Note the green felt strips on either side of the road representing vegetative buffers

Watershed

2nd graders at Legend Elementary watching a watershed presentation

Cleaning up the Model

Blot the model dry when you are done using it. I usually hose the plastic model off in the shower at home or in the janitor's sink at work after I have given a presentation

Leave the felt wetlands and grass buffer zones to dry flat

The adhesive on these pieces will wear off over time, so eventually you will have to order new ones.

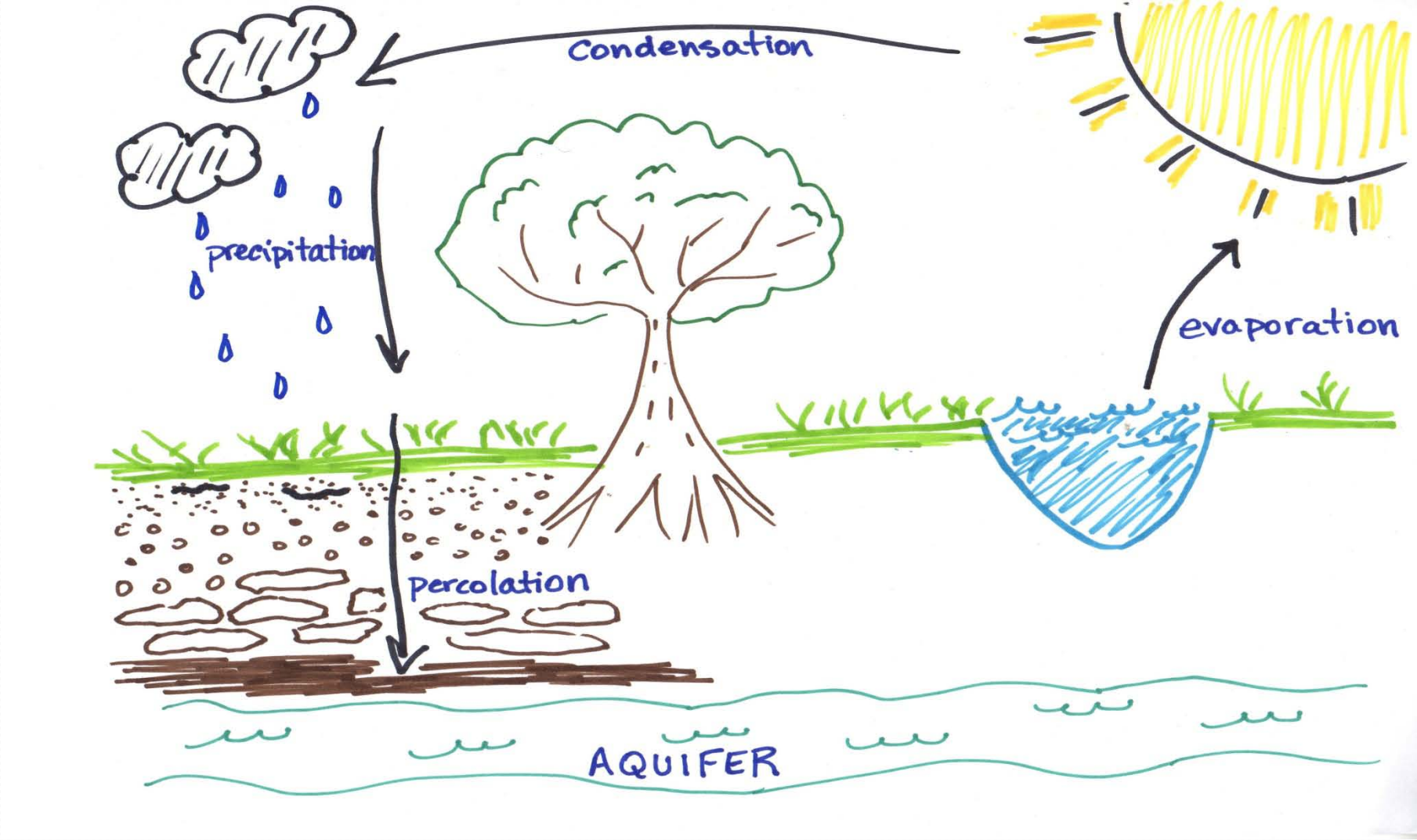
Rinse off all the other pieces and leave out to air dry overnight

Aquifers

- A common misconception about groundwater is that if it comes from underground, it must be clean
- This activity shows how some pollutants are filtered out by the physical characteristics of the ground itself while others pass through into the water table
- This is a good way to illustrate how some pollutants are water soluble and others are insoluble

- ***Start your presentation with drawing the water cycle on the board***

Aquifers


Condensation
precipitation
evaporation
percolation
AQUIFER

Aquifers

- Explain that Aquifers provide drinking water for approximately half of all Americans
- Explain that a drinking water well is like sticking a straw into the earth all the way into the water the aquifer holds
- Explain the after an aquifer is contaminated cleaning it up costs a lot of money and can take several years to make the water drinkable again
- Explain that sometimes aquifers have to be abandoned because it is too expensive to clean up the pollution or the mess is too big

Aquifer Models

Disposable water bottle cut in half

Pea gravel

Screen

Modeling clay

Cotton balls

Water

Coffee

Food dye

Aquifer Models

Place 2 cotton balls (spread out) in the opening of the bottle. These represent large subterranean sandstone and other semi-permeable rocks that help filter water

Place some screen on top of the cotton balls. Hold it in place with modeling clay. The screen will support the pea gravel

Aquifer Models

Wash the pea gravel before you use it….it will be DUSTY!

Aquifer Models

Pour the pea gravel into the water bottle on top of the screen

Aquifer Models

Into a cup, mix ground coffee and food dye (the color of your soluble pollution is up to you!)

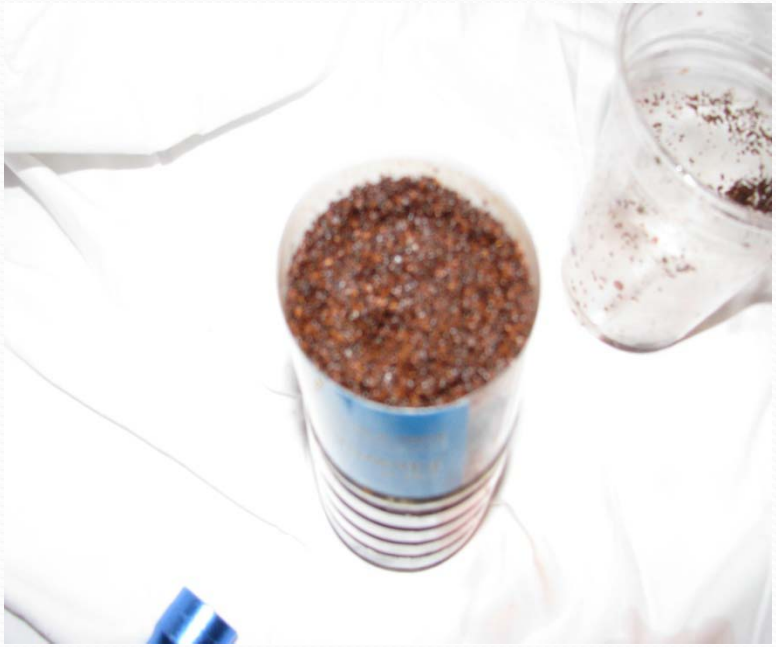
Aquifer Models

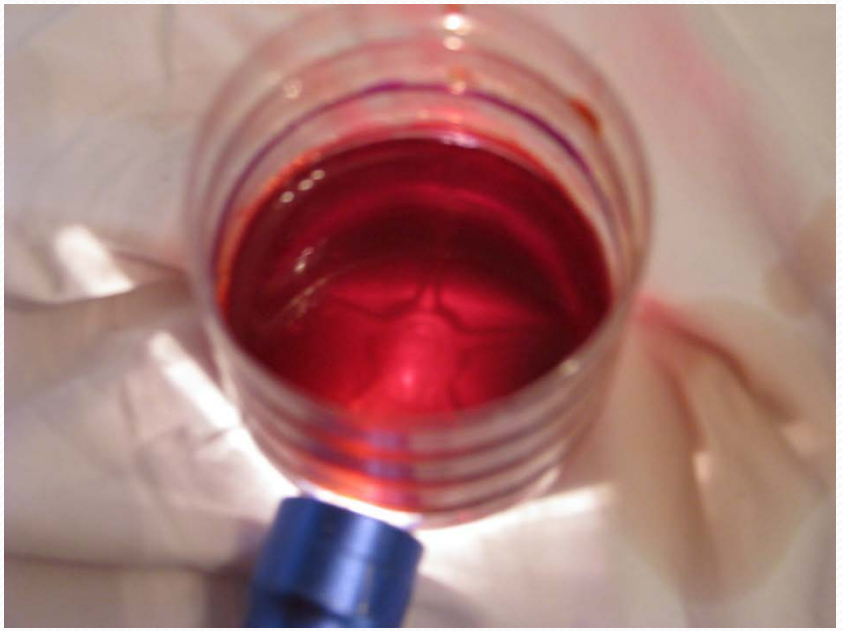
Aquifer Models

Pour the pollution slurry into your cup.

This represents pollution, carried by rain, soaking into the earth

Aquifer Models





The *insoluble* pollution (coffee) will stay on top of the rocks

The *soluble* pollution (food coloring) will stay dissolved in the water and pass through into the aquifer (water under ground)

Aquifer Models

Another way to do this activity that is truer to real life:

- Have the kids apply dry coffee to the top of the rocks
- Add a couple drops of food coloring on top of the coffee
- Pour clean water over the top
- Watch the food dye travel into the “aquifer” while the coffee stays put

Aquifer Models

The final step to this activity that connects it to Drinking Water is to tell the kids that this aquifer is in the country and the house that sits on top of this aquifer needs to build a well to get some drinking water

Use a disposable pipette

Ask the kids if they would like to drink it

Explain that not all pollution can be seen as easily as the food dye

Some pollution can't be seen or smelled, it just makes you sick if you drink it

Aquifer = Drinking Water

Conclusion

- As the total number of available workers shrinks, the wastewater industry will see increased competition to attract and retain talented personnel
- One of the best ways to attract workers is to cultivate a sense of environmental responsibility among our young people
- Everyone needs to be educated about what we REALLY do at the wastewater treatment plant; kids will pick up their parents' misconceptions unless we teach them otherwise

- Teachers LOVE to have guest speakers in their classroom the talk about their careers!

- YOU are experts in the wastewater field

- It is never too soon to expose young people to the idea that they will need to attend college after graduating high school (this starts in 2nd grade in the Newark City Schools)

- If you choose to speak in the classroom, be sure to talk about your education and the need for math and science in your everyday work tasks

- Clean Water lessons can be fun and engaging for children, they don't have to be boring lectures
- Elementary school kids are very bright and generally ask a lot of thoughtful questions
- Don't be intimidated by the class. Usually they will be on their best behavior for a guest speaker
- Have fun! If you are having fun, the kids will too
- Teach kids to care about clean water and we will see the benefits in the years to come; a cleaner world and (hopefully) some new talent coming into our industry

Thank You

Be inspired to change the world one kid at a time!